Amendments to the Claims:

Please cancel claims 98-111 without prejudice.

Please amend the claims as follows. Applicant submits that the amendments made to the claims were made to correct claim drafting errors and to further define the scope of the claims. The amendments were not made in response to the cited art. A complete listing of the claims and their status follows.

1. (previously amended) A clay-polymer nanocomposite comprising an organoclay which has been exfoliated into a polymer matrix, the organoclay being the reaction product of a smectite clay with a quaternary onium compound mixture, wherein the quaternary onium compound mixture comprises a diester quaternary ammonium compound mixed with an additional quaternary ammonium compound, wherein the additional quaternary ammonium compound comprises a triester quaternary ammonium compound, a monoester quaternary ammonium compound, or mixtures thereof.

2. - 3. (cancelled)

4. (previously amended)The nanocomposite of claim 1, wherein the diester quaternary ammonium compound is present as greater than 55 wt% of the quaternary onium compound mixture.

5. (currently amended) The nanocomposite of claim 1, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound and wherein the triester quaternary ammonium compound comprises less than ~~about~~ 25 wt.% of the quaternary onium compound mixture.

6. (previously amended) The nanocomposite of claim 1, wherein the fatty acids corresponding to the esters of the diester quaternary ammonium compound and the additional quaternary

ammonium compound have a degree of unsaturation such that the iodine value is from about 20 to about 90.

7. (currently amended) The nanocomposite of claim 1, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound, and wherein the diester quaternary ammonium compound comprises greater than ~~about~~ 60 wt.% of the quaternary onium mixtures, the triester quaternary ammonium compound comprises less than ~~about~~ 20 wt.% of the quaternary onium mixture, and wherein the fatty acids corresponding to the esters in the diester quaternary ammonium compound and the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value is from about 30 to about 70.

8. (currently amended) The nanocomposite of claim 1, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound, and wherein the diester quaternary ammonium compound comprises greater than ~~about~~ 62 wt% of the quaternary onium mixture, the triester quaternary ammonium compound comprises less than ~~about~~ 17 wt% of the quaternary onium mixture and wherein the fatty acids corresponding to the esters in the diester quaternary ammonium compound, and wherein the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value is from about 40 to about 60.

9. (currently amended) The nanocomposite of claim 1, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound and wherein the diester quaternary ammonium compound comprises greater than ~~about~~ 62 wt.% of the quaternary onium mixture, the triester quaternary ammonium compound comprises less than ~~about~~ 17 wt.% of the quaternary onium mixture, and wherein the fatty acids corresponding to the esters in the diester quaternary ammonium compound and the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value of the fatty acids is from about 45 to about 58.

10. (previously amended) An organoclay comprising the reaction product of a smectite clay with a quaternary onium compound mixture wherein the quaternary onium compound mixture comprises a diester quaternary ammonium compound mixed with an additional quaternary ammonium compound, wherein the additional quaternary ammonium compound comprises a

triester quaternary ammonium compound, a monoester quaternary ammonium compound, or mixtures thereof.

11. (cancelled)

12. (currently amended) The organoclay composition of claim 10, wherein the diester quaternary compound comprises greater than ~~about~~ 55 wt.% of the quaternary mixture.

13. (currently amended) The organoclay composition of claim 12, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound, and wherein the triester quaternary ammonium compound comprises less than ~~about~~ 25 wt% of the quaternary onium mixture.

14. (cancelled)

15. (previously amended) The organoclay composition of claim 10, wherein the fatty acids corresponding to the esters in the diester quaternary ammonium compound and the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value is from about 20 to about 90.

16. (currently amended) The organoclay composition of claim 10, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound, and wherein the diester quaternary ammonium compound comprises greater than ~~about~~ 60 wt.% of the quaternary onium mixture, the triester quaternary ammonium compound comprises less than ~~about~~ 20 wt.% of the quaternary onium mixture, and wherein the fatty acids corresponding to the esters in the diester quaternary ammonium compound and the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value is from about 30 to about 70.

17. (currently amended) The organoclay composition of claim 10, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound, and wherein the diester quaternary ammonium compound comprises greater than ~~about~~ 62 wt.% of the quaternary

onium mixture, the triester quaternary ammonium compound comprises less than ~~about~~ 17 wt.% of the quaternary onium mixture, and wherein the fatty acids corresponding to the esters in the diester quaternary ammonium compound and the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value is from about 40 to about 60.

18. (original) The organoclay composition of claim 10, wherein the fatty acids corresponding to the esters of the diester quaternary ammonium compound and the additional quaternary ammonium have a degree of unsaturation such that the iodine value is from about 45 to about 58.

19. (original) The organoclay composition of claim 10, wherein the smectite is selected from the group consisting of hectorite, montmorillonite, bentonite, beidellite, saponite, stevensite and mixtures thereof.

20. (original) The organoclay composition of claim 19, wherein the smectite comprises hectorite.

21. - 30. (cancelled)

31. (previously amended) A method for preparing a nanocomposite comprising:

contacting a smectite clay with a quaternary onium compound mixture comprising a diester quaternary ammonium compound mixed with an additional quaternary ammonium compound, wherein the additional quaternary ammonium compound comprises a triester quaternary ammonium compound, a monoester quaternary ammonium compound, or mixtures thereof; and

intermixing an organoclay with a polymer matrix.

32. (currently amended) The nanocomposite of claim 31, wherein the diester quaternary ammonium compound comprises greater than ~~about~~ 55 wt.% of the quaternary onium compound mixture.

33. (currently amended) The nanocomposite of claim 31, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound and wherein the triester quaternary ammonium compound comprises less than ~~about~~ 25 wt.% of the quaternary onium compound mixture.

35. (previously amended) The nanocomposite of claim 31, wherein the fatty acids corresponding to the esters of the diester quaternary ammonium compound and the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value is from about 20 to about 90.

36. (currently amended) The nanocomposite of claim 31, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound, and wherein the diester quaternary ammonium compound comprises greater than ~~about~~ 60 wt.% of the quaternary onium mixture, the triester quaternary ammonium compound comprises less than ~~about~~ 20 wt.% of the quaternary onium mixture, and wherein the fatty acids corresponding to the esters in the diester quaternary ammonium compound and the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value is from about 30 to about 70.

37. (currently amended) The nanocomposite of claim 31, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound, and wherein the diester quaternary ammonium compound comprises greater than ~~about~~ 62 wt.% of the quaternary onium mixture, the triester quaternary ammonium compound comprises less than ~~about~~ 17 wt.% of the quaternary onium mixture, and wherein the fatty acids corresponding to the esters in the diester quaternary ammonium compound and the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value is from about 40 to about 60.

38. (currently amended) The nanocomposite of claim 31, wherein the additional quaternary ammonium compound is a triester quaternary ammonium compound, and wherein the diester quaternary ammonium compound comprises greater than ~~about~~ 62 wt.% of the quaternary onium mixture, the triester quaternary ammonium compound comprises less than ~~about~~ 17 wt.% of the

quaternary onium mixture, and wherein the fatty acids corresponding to the esters in the diester quaternary ammonium compound and the additional quaternary ammonium compound have a degree of unsaturation such that the iodine value is from about 48 to about 58.

39. (previously added) The nanocomposite of claim 31, wherein the smectite clay is further subjected to a shearing treatment.

40. (previously added) The nanocomposite of claim 31, wherein the organoclay is further subjected to shearing.

41. (previously added) The method of claim 31, wherein intermixing the organoclay with the polymer matrix further comprises extruding the organoclay with the polymer matrix.

42. – 44. (cancelled).

45. (currently amended) The nanocomposite of claim 1, wherein the diester quaternary ammonium compound, triester quaternary ammonium compound, and monoester quaternary ammonium compound, are the reaction products of C_{12}-C_{22} fatty acids or the hydrogenation products thereof, or a mixture of such acids, with an alkanolamine in the presence of an acid catalyst wherein the ratio of fatty acids to alkanolamine is from about 1.40 to about 2.0.

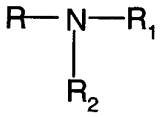
46. (currently amended) The organoclay of claim 10, wherein the diester quaternary ammonium compound, triester quaternary ammonium compound, and monoester quaternary ammonium compound, are the reaction products of C_{12}-C_{22} fatty acids or the hydrogenation products thereof, or a mixture of such acids, with an alkanolamine in the presence of an acid catalyst wherein the ratio of fatty acids to alkanolamine is from about 1.40 to about 2.0.

47. (currently amended) The nanocomposite of claim 31, wherein the diester quaternary ammonium compound, triester quaternary ammonium compound, and monoester quaternary ammonium compound, are the reaction products of C_{12}-C_{22} fatty acids or the hydrogenation

products thereof, or a mixture of such acids, with an alkanolamine in the presence of an acid catalyst wherein the ratio of fatty acids to alkanolamine is from about 1.40 to about 2.0.

48. (currently amended) A nanocomposite comprising an organoclay which has been exfoliated into a polymer matrix, the organoclay being ~~the~~ a reaction product of a smectite clay with a quaternary ammonium component, wherein the quaternary ammonium component is ~~derived from~~ prepared by ~~a process~~ a method comprising:

mixing at a temperature of about 70 °C a C_{12}-C_{22} fatty acid or mixture of fatty acids having an iodine value of from about 3 to about 90, with an alkanolamine of the formula:



wherein R, R_1 and R_2 are independently selected from C_2-C_6 hydroxyalkyl groups, and wherein the molar ratio of the fatty acid to the alkanolamine is from about 1.4 to about 2.0,

increasing the temperature of the mixture of the fatty acid and the alkanolamine from about 70 °C to a range of from about 170 °C to about 250 °C, wherein the rate of temperature increase is maintained at an average rate of greater than about 0.4 °C per minute to produce a mixture of about 55 wt % of a diester compound and less than ~~about~~ 25 wt % of a triester compound; and

alkylating the produced diester and triester compounds with an alkylating agent to form the quaternary ammonium component.

49. (currently amended) The nanocomposite of claim 48, wherein the rate of temperature increase is maintained at an average rate greater than ~~about~~ 0.8 °C per minute.

50. (currently amended) The nanocomposite of claim 48, wherein the fatty acid is a C_{16}-C_{22} fatty acid having an iodine value of from about 40 to about 60.

51. (currently amended) The nanocomposite of claim 48, wherein the fatty acid is a C_{16}-C_{22} fatty acid having an iodine value of from about 45 to about 55.

52. (currently amended) The nanocomposite of claim 48, wherein the fatty acid is ~~derived from~~ tallow, soy, palm, palm kernel, rape seed, canola, tall oil, lard or mixtures thereof.

53. (previously amended) The nanocomposite of claim 48, wherein the alkanolamine is selected from the group consisting of triethanolamine, propanol diethanolamine, ethanol diisopropanolamine, triisopropanol amine, diethanolisopropanol amine, ethanoldiisobutanolamine, diethanolisobutanolamine and mixtures thereof.

54. (currently amended) The nanocomposite of claim 48, wherein the molar ratio of the fatty acid to the alkanolamine is in the range of from about 1.60 to about 1.90.

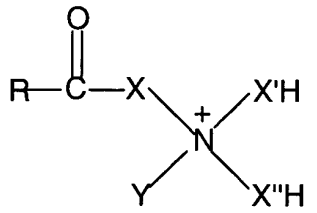
55. (currently amended) The nanocomposite of claim 48, wherein the molar ratio of the fatty acid to the alkanolamine is in the range of from about 1.68 to about 1.72.

56. (currently amended) The nanocomposite of claim 48, wherein the fatty acid has less than ~~about~~ 10% trans isomer.

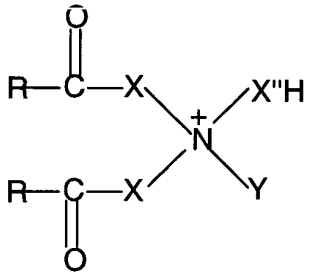
57. (previously amended) The nanocomposite of claim 48, wherein the alkylating agent is selected from the group consisting of methyl chloride, benzyl chloride, ethyl chloride, diethyl sulfate, dimethyl carbonate, trimethyl phosphate, dimethyl sulfate and mixtures thereof.

58. (currently amended) A nanocomposite comprising an organoclay which has been exfoliated into a polymer matrix, the organoclay being the reaction product of a smectite clay with a quaternary ammonium component, the quaternary ammonium component comprising a

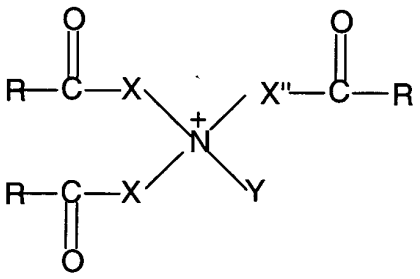
monoester compound of formula (I), a diester compound of formula (II), and a triester compound of formula (III):



Z^- I)



Z^- II)

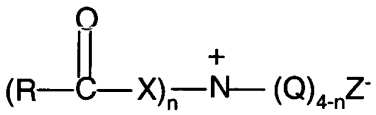


Z^- III)

wherein X, X' and X'' are the same or different and are selected from straight or branched chain, oxyalkylene or polyoxyalkylene groups having from 2-6 carbon atoms where the oxyalkylene units number from about 1-10, each R group is individually selected from straight or branched chain alkyl or alkylene groups having from 11 to 23 carbon atoms, Y is and alkylphenyl group or a straight or branched chain C_1 to C_6 alkyl or alkylene group; and Z- represents a halogen or sulfate;

wherein the diester compound comprises greater than ~~about~~ 55 wt.% of the quaternary ammonium component and wherein the triester compound comprises less than ~~about~~ 25 wt.% of the quaternary ammonium component.

59. (currently amended) A nanocomposite comprising an organoclay which has been exfoliated into a polymer matrix, the organoclay being the reaction product of a smectite clay with a quaternary ammonium component, the quaternary ammonium component comprising one or more compounds having the general formula (IV):



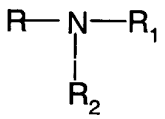
wherein n is an integer from 1 to 2, R is a C_5 to C_{23} straight or branched chain alkyl or alkylene group, each X can be the same or different and is selected from straight or branched chain oxyalkylene or polyoxyalkylene groups having from 2-6 carbon atoms; each Q can be the same or different and is selected from a oxyalkylene or polyoxyalkylene group, or straight or branched chain alkyl, alkylene, alkyl phenyl, hydroxyalkyl, or hydroxyalkylene group, wherein at least one of ~~said~~ the Q groups is a C_2 to C_6 linear or branched chain oxyalkylene or polyoxyalkylene capped with a C_1 to C_6 alkyl, or an alkyl phenyl group; and Z^- is a halogen or sulfate.

60. - 62. (cancelled)

63. (currently amended) The nanocomposite of claim 59, wherein the quaternary ammonium component comprises a diester quaternary ammonium compound and a monoester quaternary ammonium compound, and wherein the diester quaternary ammonium compound comprises at least ~~about~~ 70% by weight of the quaternary ammonium component.

64. (currently amended) A nanocomposite comprising an organoclay which has been exfoliated into a polymer matrix, the organoclay being the reaction product of a smectite clay with a quaternary ammonium component, wherein the quaternary ammonium component is ~~derived from a process~~ prepared by a method comprising:

reacting a C_{11}-C_{23} fatty acid or mixture of fatty acids having an iodine value of from about 20 to about 90, with an ether alkanolamine of the formula:



wherein R is a C_2-C_6 alkyl ether, and each of R_1 and R_2 is independently selected from C_2-C_6 hydroxyalkyl groups, and wherein the molar ratio of the fatty acid to the ether alkanolamine is from about 1.4 to about 2.0; and

alkylating the product of the reaction of the fatty acid with the ether alkanolamine with an alkylating agent to form the quaternary ammonium component.

65. (currently amended) The nanocomposite of claim 64, wherein the fatty acid is a C_{16}-C_{22} fatty acid having an iodine value of from about 40 to about 60.

66. (currently amended) The nanocomposite of claim 64, wherein the fatty acid is ~~derived from~~ tallow, soy, palm, palm kernel, rape seed, canola, tall oil, lard or mixtures thereof.

67. (previously amended) The nanocomposite of claim 64, wherein the ether alkanolamine is selected from the group consisting of methoxyethyldiethanolamine, methoxypropyldiethanolamine. methoxybutyldiethanolamine and mixtures thereof.

68. (previously amended) The nanocomposite of claim 64, wherein the molar ratio of fatty acid to ether alkanolamine is in the range of from about 1.60 to about 1.90.

69. (previously amended) The nanocomposite of claim 64, wherein the alkylating agent is selected from the group consisting of methyl chloride, benzyl chloride, ethyl chloride, diethyl sulfate, dimethyl carbonate, trimethyl phosphate, dimethyl sulfate or mixtures thereof.

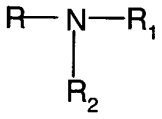
70. (previously amended) The nanocomposite of claim 64, wherein the alkylating agent is methyl chloride.

71. (previously amended) The nanocomposite of claim 64, wherein the process is conducted in the presence of a solvent.

72. (previously amended) The nanocomposite of claim 64, wherein the process is conducted in the presence of a solvent, wherein the solvent is selected from the group consisting of C_1-C_6 alcohols, glycols, fatty acid, mono-, di-, or tri-glycerides, and mixtures thereof.

73. (currently amended) An organoclay comprising the reaction product of a smectite clay with a quaternary ammonium component, wherein the quaternary ammonium component is ~~derived from a process~~ prepared by a method comprising:

mixing at a temperature of about 70 °C a C_{12}-C_{22} fatty acid or mixture of fatty acids having an iodine value of from about 3 to about 90, with an alkanolamine of the formula:



wherein R, R_1 and R_2 are independently selected from C_2-C_6 hydroxyalkyl groups, and wherein the molar ratio of the fatty acid to the alkanolamine is from about 1.4 to about 2.0,

increasing the temperature of the mixture of the fatty acid and the alkanolamine from about 70 °C to a range of from about 170 °C to about 250 °C, wherein the rate of temperature increase is maintained at an average rate of greater than about 0.4 °C per minute to produce a mixture of ~~about~~ greater than 55 wt % of a diester compound and less than ~~about~~ 25 wt % of a triester compound; and

alkylating the produced diester and triester compounds with an alkylating agent to form the quaternary ammonium component.

74. (currently amended) The organoclay of claim 73, wherein the rate of temperature increase is maintained at an average rate greater than ~~about~~ 0.8 °C per minute.

75. (currently amended) The organoclay of claim 73, wherein the fatty acid is a C_{16}-C_{22} fatty acid having an iodine value of from about 40 to about 60.

76. (currently amended) The organoclay of claim 73, wherein the fatty acid is a C_{16}-C_{22} fatty acid having an iodine value of from about 45 to about 55.

77. (currently amended) The organoclay of claim 73, wherein the fatty acid is ~~derived from~~ tallow, soy, palm, palm kernel, rape seed, canola, tall oil, lard or mixtures thereof.

78. (previously amended) The organoclay of claim 73, wherein the alkanolamine is selected from the group consisting of triethanolamine, propanol diethanolamine, ethanol diisopropanolamine, triisopropanol amine, diethanolisopropanol amine, ethanoldiisobutanolamine, diethanolisobutanolamine and mixtures thereof.

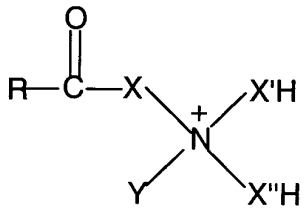
79. (currently amended) The organoclay of claim 73, wherein the molar ratio of the fatty acid to the alkanolamine is in the range of from about 1.60 to about 1.90.

80. (currently amended) The organoclay of claim 73, wherein the molar ratio of the fatty acid to the alkanolamine is in the range of from about 1.68 to about 1.72.

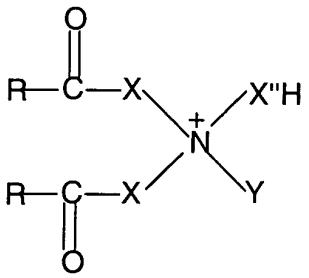
81. (currently amended) The organoclay of claim 73, wherein the fatty acid has less than ~~about~~ 10% trans isomer.

82. (previously amended) The organoclay of claim 73, wherein the alkylating agent is selected from the group consisting of methyl chloride, benzyl chloride, ethyl chloride, diethyl sulfate, dimethyl carbonate, trimethyl phosphate, dimethyl sulfate and mixtures thereof.

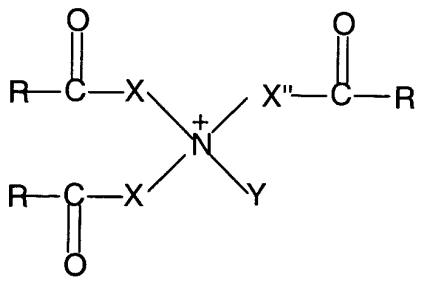
83. (currently amended) An organoclay comprising a reaction product of a smectite clay with a quaternary ammonium component, the quaternary ammonium component comprising a monoester compound of formula (I), a diester compound of formula (II), and a triester compound of formula (III):



Z^- I)



Z^- II)

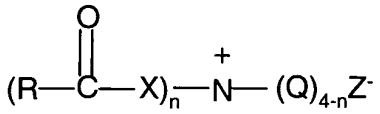


Z^- III)

wherein X, X' and X'' are the same or different and are selected from straight or branched chain oxyalkylene or polyoxyalkylene groups having from 2-6 carbon atoms, where the oxyalkylene units number from about 1-10, each R group is individually selected from straight or branched chain alkyl or alkylene groups having from 11 to 23 carbon atoms, Y is and alkylphenyl group or a straight or branched chain C_1 to C_6 alkyl or alkylene group; and Z- represents a halogen or sulfate;

wherein the diester compound comprises greater than ~~about~~ 55 wt.% of the quaternary ammonium component and wherein the triester compound comprises less than ~~about~~ 25 wt.% of the quaternary ammonium component.

84. (currently amended) An organoclay comprising the reaction product of a smectite clay with a quaternary ammonium component, the quaternary ammonium component comprising one or more compounds having the general formula (IV):



wherein n is an integer from 1 to 2, R is a C_5 to C_{23} straight or branched chain alkyl or alkylene group, each X can be the same or different and is selected from straight or branched chain, oxyalkylene or polyoxyalkylene groups having from 2-6 carbon atoms;

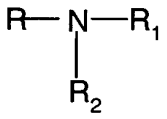
each Q can be the same or different and is selected from a oxyalkylene or polyoxyalkylene group, or straight or branched chain alkyl, alkylene, alkyl phenyl, hydroxyalkyl, or hydroxyalkylene group, wherein at least one of ~~said~~ the Q groups is a C_2 to C_6 linear or branched chain oxyalkylene or polyoxyalkylene capped with a C_1 to C_6 alkyl, or an alkyl phenyl group; and Z^- is a halogen or sulfate.

85. - 87. (cancelled).

88. (previously added) The organoclay of claim 84, wherein the quaternary ammonium component comprises a diester quaternary ammonium compound and a monoester quaternary ammonium compound, and wherein the diester quaternary ammonium compound comprises at least about 70% by weight of the quaternary ammonium component.

89. (currently amended) An organoclay comprising a reaction product of a smectite clay with a quaternary ammonium component, wherein the quaternary ammonium component is ~~derived from a process~~ prepared by a method comprising:

reacting a C_{11}-C_{23} fatty acid or mixture of fatty acids having an iodine value of from about 20 to about 90, with an ether alkanolamine of the formula:



wherein R is a C_2-C_6 alkyl ether, and each of R_1 and R_2 is independently selected from C_2-C_6 hydroxyalkyl groups, and wherein the molar ratio of the fatty acid to the ether alkanolamine is from about 1.4 to about 2.0; and

alkylating the product of the reaction of the fatty acid with the ether alkanolamine with an alkylating agent to form the quaternary ammonium component.

90. (currently amended) The organoclay of claim 89, wherein the fatty acid is a C_{16}-C_{22} fatty acid having an iodine value of from about 40 to about 60.

91. (currently amended) The organoclay of claim 89 wherein, the fatty acid is ~~derived from~~ tallow, soy, palm, palm kernel, rape seed, canola, tall oil, lard or mixtures thereof.

92. (previously amended) The organoclay of claim 89 wherein, the ether alkanolamine is selected from the group consisting of methoxyethyldiethanolamine, methoxypropyldiethanolamine, methoxybutyldiethanolamine and mixtures thereof.

93. (previously amended) The organoclay of claim 89 wherein, the molar ratio of fatty acid to ether alkanolamine is in the range of from about 1.60 to about 1.90.

94. (previously amended)The organoclay of claim 89, wherein the alkylating agent is selected from the group consisting of methyl chloride, benzyl chloride, ethyl chloride, diethyl sulfate, dimethyl carbonate, trimethyl phosphate, dimethyl sulfate or mixtures thereof.

95. (previously amended) The organoclay of claim 89, wherein the alkylating agent is methyl chloride.

96. (previously amended) The organoclay of claim 89, wherein the process is conducted in the presence of a solvent.

97. (previously amended) The organoclay of claim 89, wherein the process is conducted in the presence of a solvent, wherein the solvent is selected from the group consisting of C_1-C_6 alcohols, glycols, fatty acid, mono-, di-, or tri-glycerides, and mixtures thereof.

98. – 111. (cancelled).

112. (currently amended) The nanocomposite of claim 64, wherein the fatty acid has less than

~~about~~ 20% trans isomer.

113. (previously added) The nanocomposite of claim 64, wherein the alkyl ether is selected from a group consisting of, methoxyethyl ether, methoxypropyl ether, methoxybutyl ether and mixtures thereof.

114. (previously added) The nanocomposite of claim 64, wherein the hydroxyalkyl group is selected from a group consisting of ethanol, propanol, isopropanol, isobutanol and mixtures thereof.

115. (previously added) The organoclay of claim 84, wherein the alkyl ether is selected from a group consisting of, methoxyethyl ether, methoxypropyl ether, methoxybutyl ether and mixtures thereof.

116. (currently amended) The organoclay of claim 84, wherein the fatty acid has less than ~~about~~ 20% trans isomer.

117. (previously amended) The organoclay of claim 84, wherein the hydroxyalkyl group is selected from a group consisting of ethanol, propanol, isopropanol, isobutanol and mixtures thereof.

Response to Office Action Mailed April 9, 2003

A. Claims In The Case

Claims 1, 4-10, 12, 13, 15-20 31-33, 35-41, 45-59, 63-84, 88-97 and 112-117 are pending. Claims 98-111 have been canceled. Claims 1, 4-10, 12, 13, 15-20 31-33, 35-41, 45, 48, 50-52, 63-66, 71, 73, 75-77, 81, 83, 84, 88, 89-91, 112 and 116 have been rejected. Claims 46, 47, 49, 53-55, 57, 67-70, 72, 74, 78-80, 82, 92-95, 97, 113-115 and 116 are objected. Claims 5, 7-9, 12, 13,16, 17, 32, 33, 36-38, 45-52, 54-56, 58, 59, 63-66, 73-77, 79-81, 83, 84, 89-91, 112 and 116 have been amended.

B. The Claims Are Definite Pursuant To 35 U.S.C. § 112, Second Paragraph

Claims 5, 7-9, 12, 13,16, 17, 32, 33, 36-38, 48, 49, 52, 56, 58, 63, 64, 66, 73, 77, 81, 83, 89, 112 and 116 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant respectfully disagrees. Applicant, however, has amended claims 5, 7-9, 12, 13,16, 17, 32, 33, 36-38, 48, 49, 52, 56, 58, 63, 64, 66, 73, 77, 81, 83, 89, 112 and 116 for clarification.

C. The Claims Are Not Anticipated Over Gonzalez Pursuant To 35 U.S.C. § 102(b)

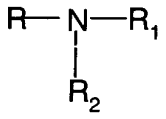
The Examiner has rejected claims 73, 75-77, 84 and 89-91 as being unpatentable over PCT Application No. WO 97/30950 to Gonzalez et al. (hereinafter "Gonzalez"). Applicant respectfully disagrees with these rejections.

The standard for "anticipation" is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 U.S.P.Q.81, 91 (Fed. Cir. 1986); *In re Donahue*, 766 F.2d 531, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985).

Claim 73 describes a combination of features including, but not limited to, the features of:

An organoclay comprising the reaction product of a smectite clay with a quaternary ammonium component, wherein the quaternary ammonium component is prepared by a method comprising:

mixing at a temperature of about 70 °C a C_{12}-C_{22} fatty acid or mixture of fatty acids having an iodine value of from about 3 to about 90, with an alkanolamine of the formula:



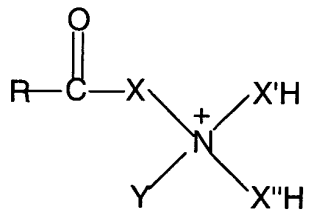
wherein R, R_1 and R_2 are independently selected from C_2-C_6 hydroxyalkyl groups, and wherein the molar ratio of the fatty acid to the alkanolamine is from about 1.4 to about 2.0,

.....to produce a mixture of greater than 55 wt % of a diester compound and less than 25 wt% of a triester compound...

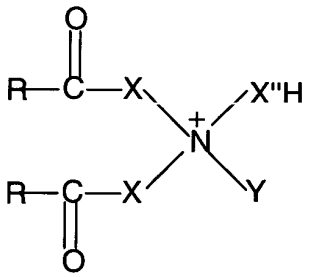
Applicant's specification states,

The quaternary ammonium compounds which are reacted with the smectite clays to produce the organoclays of the present invention are high in diester and low in triester content. They are obtained by reaction of C_{12} - C_{22} fatty acids or the hydrogenation products thereof, or a mixture of such acids, with an alkanolamine in the presence of an acid catalyst, wherein the ratio of fatty acid to alkanolamine is from about 1.40 to 2.0. The resultant ester amine reaction products are subsequently quaternized to obtain quaternary ammonium salts for reaction with the smectite. In an embodiment, the fatty acid may be a C_{16} - C_{22} acid containing a degree of unsaturation such that the iodine value ("IV") is in the range of from about 3-90, in other embodiments, from about 20-90, in other embodiments, in the range of 40-60, and in other embodiments in the range of from about 45-55. Fatty acids include but are not limited to oleic, palmitic, erucic, eicosanic, and mixtures thereof. Soy, tallow, palm, palm kernel, rape seed, lard, mixtures thereof and the like are typical sources for fatty acid which may be employed.
(Specification, page 6, line 24 through page 7, line 7)

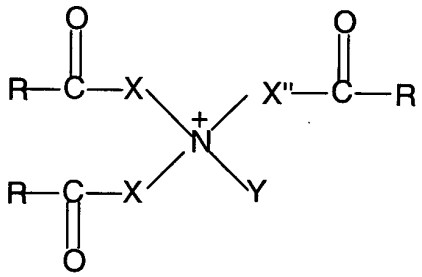
In an embodiment, the quaternary ammonium salt includes a mixture of mono - (I), di- (II) and triester (III) components of the following formulae:



Z^- I)



Z^- II)

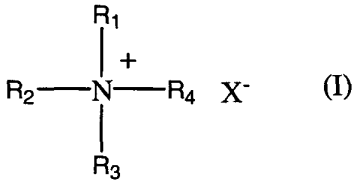


Z^- III)

wherein:

X, X' and X'' are the same or different and are selected from straight or branched chain, optionally substituted oxyalkylene or polyoxyalkylene groups having from 2-6 carbon atoms, in other embodiments, 3-6 carbon atoms, where the oxyalkylene units number from about 1-10, in other embodiments, 1-5, and in other embodiments, 1-2; each R group is individually selected from straight or branched chain, optionally substituted alkyl groups having from 11 to 23 carbon atoms, Y is an alkylphenyl group or a straight or branched chain optionally substituted C_1 to C_6 alkyl or alkylene group; and Z^- represents a softener compatible anion including, but not limited to, halogen, CH_3SO_4 or $C_2H_5SO_4$. (Specification, page 9 line 24 through page 10, line 32).

Applicant submits Gonzalez does not teach the formation of a diester or a triester quaternary ammonium compound from a fatty acid. Gonzalez teaches a quaternary ammonium salt that includes an alkyl group that includes a mixture saturated or unsaturated alkyl groups having 1 to 22 carbon atoms. The quaternary ammonium salt of Gonzalez may be made by converting a fatty acid to a corresponding nitrogen containing compound (e.g., amide ($RCONH_2$)). The nitrogen-containing compound may then be converted to the corresponding amine (e.g., RCH_2NH_2) using techniques known in the art (e.g., reduction). The resulting amine is alkylated with an alkylating agent to form a quaternary ammonium compound. Gonzalez states:

> The quaternary ammonium compounds which can be utilized in the compositions of the present invention are known agents typically utilized in the preparation of organoclays and inlcude alkyl ammonium compounds of the formula
>
> 
>
> (I)
>
> wherein R_1, R_2, R_3, and R_4 are independently selected from the group consisting of lineal or branched saturated or unsaturated alkyl groups having 1 to 22 carbon atoms, aralkyl groups which are benzyl and substituted benzyl moieties, aryl group, beta, gamma unsaturated groups having six or less carbon atoms, hydroxyalkyl groups having two to six carbon atoms, and hydrogen, with the proviso that at least one of the substituents is a lineal or branched saturated unsaturated alkyl group; and X is the salt anion.
> (Gonzalez, page 3 line 24 through page 4, line 8).
>
> Representative examples of useful branched, saturated radicals include lauryl, stearyl, tridecyl, myristyl (tetradecyl,) pentadecyl, hexadecyl, hydrogenated tallow, docosanyl. Representative examples of unbranched, unsaturated and unsubstituted groups include oleyl, linoleyl, linolenyl, soya and tallow.
> (Gonzalez, Page 4, lines 22-26)
>
> Illustrative of the numerous patents which describe organic cationic salts, their manner of preparation and their use in the preparation of organophilic clays are

> commonly assigned U.S. Pat. Nos. 2,966,506, 4,081,496, 4,105,578, 4,116,866, 4208,218, 4,391,637, 4,410,364, 4,412,018, 4,434,075, 4,434,076, 4,450,095 and 4,517,112.
> (Gonzalez, page 7 lines 6-10).

Applicant submits that Gonzalez does not teach diester quaternary ammonium compounds and/or triester quaternary ammonium compounds. As such, Applicant submits that claim 73 is patentable over Gonzalez. For at least the reasons cited above, Applicant submits claims 75-77, 84, 89-91 are patentable over Gonzalez.

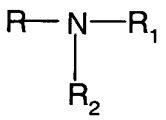
D. <u>The Claims Are Not Anticipated Over Mardis Pursuant To 35 U.S.C. § 102(b)</u>

The Examiner has rejected claims 73, 75-77, 84 and 89-91 as being unpatentable over European Patent No. EP 798,267 to Mardis et al. (hereinafter "Mardis"). Applicant respectfully disagrees with these rejections.

The standard for "anticipation" is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 U.S.P.Q.81, 91 (Fed. Cir. 1986); *In re Donahue*, 766 F.2d 531, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985).

Amended claim 73 states,

> An organoclay comprising the reaction product of a smectite clay with a quaternary ammonium component, wherein the quaternary ammonium component is prepared by a method comprising:
>
> mixing at a temperature of about 70 °C a C_{12}-C_{22} fatty acid or mixture of fatty acids having an iodine value of from about 3 to about 90, with an alkanolamine of the formula:



> wherein R, R_1 and R_2 are independently selected from C_2-C_6 hydroxyalkyl groups, and wherein the molar ratio of the fatty acid to the alkanolamine is from about 1.4 to about 2.0,
>
> increasing the temperature of the mixture of the fatty acid and the alkanolamine from about 70 °C to a range of from about 170 °C to about 250 °C, wherein the rate of temperature increase is maintained at an average rate of greater than about 0.4 °C per minute to produce a mixture of greater than 55 wt % of a diester compound and less than 25 wt % of a triester compound...

Support for the amendments is found in Applicant's specification, which states,

> In an embodiment, product compositions contemplate an ester distribution within the following ranges: greater than about 55 wt% diester and less than about 25 wt% triester, with a total fatty acid IV of from about 20 to about 90; in other embodiments, greater than about 60 wt% diester and less than about 20 wt% triester, with a total IV of from about 30 to about 70; and in still other embodiments, greater than about 62 wt% diester and less than about 17 wt% triester, with a total IV of from about 40 to about 60. In many instances triester content will be in the 10.0 to 17.0 wt% range. In an embodiment, the IV is between about 45 to about 58.
> (Specification page 11, lines 9-16).

Applicant has discovered that the use of a quaternary ammonium component with a amount of triester compound of less than 25 wt%, when combined with mineral clay, lend to the unexpected result of producing an organoclay with a high D_{001} spacing. Applicant's specification states:

> The diester quat was present as greater than 55 wt% of the quaternary mixture; and the triester quat was present as less than 25 wt%, with the fatty acids corresponding to the esters in the mixture having a degree of unsaturation such that the iodine value ("IV") is from about 20 to about 90. A wide angle x-ray scan pattern for the product resulting from the reaction is shown in Figure 1, where the detected reflection intensity in counts/second is plotted against the D-spacing in Angstrom Units. The 001 reflection peak indicates a remarkably high D_{001} spacing for the organoclay of 59.1 Å, and suggests that the organoclay will exhibit a very high exfoliation efficiency in nanocomposites.
> (Specification, page 16, line 25 through page 17, line 5).

Applicant's specification teaches the percentage of triester compound may be minimized

by controlling the rate of temperature increase. Applicant's specification states:

> By modifying esterification conditions, the amount of triesteramine component formed in the esteramine mixture may be minimized. Reducing the amount of triester component may lead to a significant reduction in quaternization reaction time. This allows one to utilize weaker alkylating agents, such as methyl chloride, which are less expensive and less toxic, without the disadvantage of excessively long reaction times. Further, the performance of the final product is in no way impaired and, in fact, an improvement in performance is typical. Similar improvements with other alkylating agents have been observed.
>
> Triester formation in the esteramine mixture may be minimized by accelerating the heat up rate in the esterification reaction of fatty acids with alkanolamines. The accelerated heat up rate may be greater than about 0.4°C/minute, in another embodiment, greater than about 0.8°C/minute, and in another embodiment, greater than about 1.25°C/minute, from a temperature of about 70°C to a temperature in a range of from between 170°C to 250°C, is effective in minimizing triester formation in the ester amine mixture.
> (Specification, page 9, lines 2-17).

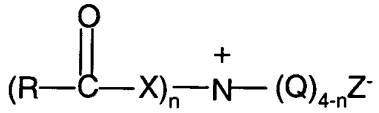
Applicant submits Mardis does not appear to teach or suggest combination of features of the claim, including but not limited to, the features of: "wherein the rate of temperature increase is maintained at an average rate of greater than about 0.4 °C per minute to produce a mixture of greater than 55 wt % of a diester compound and less than 25 wt % of a triester compound." Mardis appears to teach forming ester groups by controlling the ratio of fatty acid to alkanol amine. Mardis states:

> The preparation of quaternary compounds used to make organophilic clays of this invention can be achieved by techniques known in the art...the practitioner will recognize that the molar ratio of fatty acid that react with the hydroxyl moieties of the alkanol amine preferable should be at most 1:1, and can be less than 1:1. When the ratio is less than 1:1, then the resulting ester groups will be statistically distributed among the alkanol groups.
> (Mardis, page 7, lines 50-56).

Applicant submits that there does not appear to be any teaching or suggestion in Mardis that would lead one of ordinary skill in the art to maintain an average rate of temperature increase of greater than 0.4 °C to produce the quaternary ammonium compounds recited in Applicant's claim. As such, Applicant submits claims 73 and 75-77 are patentable over Mardis.

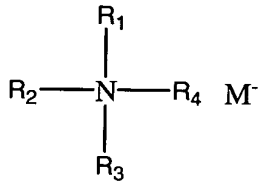
Amended claim 84 states:

An organoclay comprising the reaction product of a smectite clay with a quaternary ammonium component, the quaternary ammonium component comprising one or more compounds having the general formula (IV):



wherein n is an integer from 1 to 2, R is a C_5 to C_{23} straight or branched chain alkyl or alkylene group, each X can be the same or different and is selected from straight or branched chain oxyalkylene or polyoxyalkylene groups having from 2-6 carbon atoms; each Q can be the same or different and is selected from a oxyalkylene or polyoxyalkylene group, or straight or branched chain alkyl, alkylene, alkyl phenyl, hydroxyalkyl, or hydroxyalkylene group, wherein at least one of the Q groups is a C_2 to C_6 linear or branched chain oxyalkylene or polyoxyalkylene capped with a C_1 to C_6 alkyl, or an alkyl phenyl group; and Z^- is a halogen or sulfate.

Applicant submits Mardis does not appear to teach or suggest the feature of the claim including, but not limited to, "wherein at least one of said Q groups is a C_2 to C_6 linear or branched chain oxyalkylene or polyoxyalkylene capped with a C_1 to C_6 alkyl, or an alkyl phenyl group." Mardis appears to teach a hydroxyalkyl groups (e.g., ROH). Mardis states:



wherein R_1 is an alkyl or aralkyl-ester group having 8 to 30 carbon atoms as described below and R_2, R_3, and R_4 are independently selected from the group of (i) R_1, (ii) linear or branched alkyl (including methyl), aliphatic or aromatic groups having 1 to 30 carbon atoms (such groups can also include hydroxylated groups); (iii) aralkyl groups, such as benzyl and substituted benzyl moieties, including such groups having fused ring moieties having linear chains or branches of 1 to 30 carbon atoms; (iv) aryl groups such as phenyl and substituted phenyl including fused ring aromatic substituents; (v) beta, gamma unsaturated groups

having up to six carbon atoms or hydroxyalkyl groups having 2 to 6 carbon atoms; and (vi) hydrogen, with the proviso that at least one of R_2, R_3 and R_4 is R_1...
(Mardis, page 6 lines 1-17).

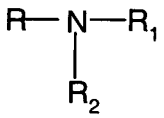
Mardis further states:

Hydroxyalkyl groups may be selected from a hydroxyl substituted aliphatic radical wherein the hydroxyl is not substituted at the carbon atom adjacent to the positively charged atom; the group has from 2 to 6 aliphatic carbons....Representative examples include 2-hydroxyethyl; 3-hydroxypropyl; 4-hydroxylpentyl; 6-hydroxyhexyl; 2-hydroxypropyl; 2-hydroxybutyl...
(Mardis, page 7, lines 36-41).

Applicant submits Mardis does not teach or suggest the features of the claim including, but not limited to, the feature of, "wherein at least one of the Q groups is a C_2 to C_6 linear or branched chain oxyalkylene or polyoxyalkylene capped with a C_1 to C_6 alkyl, or an alkyl phenyl group; and Z^- is a halogen or sulfate." Applicant submits that claim 84 is patentable over Mardis.

Claim 89 describes a combination of features including, but not limited to, the feature of:

...ether alkanolamine of the formula:



wherein R is a C_2-C_6 alkyl ether,...

Applicant submits that Mardis does not appear to teach or suggest ether groups (e.g., ROR). Mardis appears to teach, for at least the reasons cited above, hydroxyalkyl groups (e.g., ROH). Applicant submits that independent claim 89 and the claims dependent thereon (claims 90 and 91) are patentable over Mardis.

E. The Claims Are Not Anticipated Over Ross Pursuant To 35 U.S.C. § 102(e)

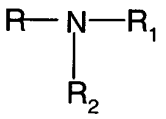
The Examiner has rejected claims 48, 50-52, 56, 58, 59, 64-66, 71, 73, 75-77, 81, 83, 84, 89-91 and 96 as being unpatentable over U.S. Patent No. 6,380,295 to Ross et al. (hereinafter "Ross"). Applicant respectfully disagrees with these rejections.

The standard for "anticipation" is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 U.S.P.Q.81, 91 (Fed. Cir. 1986); *In re Donahue*, 766 F.2d 531, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985).

Independent claims 48, 58, 73, 83 describe a combination of features including, but not limited to, the feature of "diester and triester compounds" produced from an alkanolamine (e.g., $HOCH_2CH_2NH_2$) and a fatty acid.

Independent claims 64 and 89 describe a combination of features including, but not limited to, the features of:

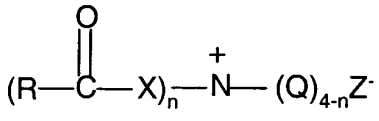
> reacting a C_{11}-C_{23} fatty acid or mixture of fatty acids having an iodine value of from about 20 to about 90 with an ether alkanolamine of the formula:



> where R is a C_2-C_6 alkyl ether, and each of R_1 and R_2 is independently selected from C_2-C_6 hydroxyalkyl groups and wherein the molar ratio of the fatty acid to the ether alkanolamine is from about 1.4 to about 2.0.

Independent claims 59 and 84 describe a combination of features including, but not limited to, the features of:

> One or more compounds having the general formula (IV):

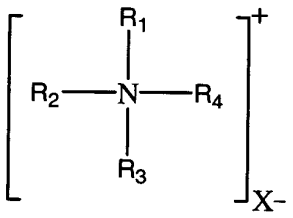


(IV)

wherein n in an integer from 1 to 2, R is a C_5 to C_{23} straight or branched chain alkyl or alkylene group, each X can be the same or different and is selected from straight or branched chain oxyalkylene or polyoxyalkylene groups having from 2-6 carbon atoms

Applicant submits Ross does not appear to teach or suggest a quaternary ammonium component that includes a mixture of diester and triester compounds. Ross appears to teach a quaternary ammonium compound that may include alkyl or allyl-ester groups. Ross states:

Compound(s) (b) of the invention is a quaternary ammonium compound(s) which include those having the formula:



Wherein R_1 comprises a group selected from (i) linear or branched aliphatic, aralkyl, or aromatic hydrocarbon groups having from 8 to 30 carbon atoms or (ii) alkyl or allyl-ester groups having 8 to 30 carbon atoms; R_2, R_3 and R_4 are independently selected from the group consisting of (a) linear or branched aliphatic, aralkyl and aromatic hydrocarbon, fluorocarbon or other halocarbon groups having from 1 to about 30 carbon atoms; (b) alkoxylated groups containing from 1 to about 80 moles of alkylene oxide; (c) amide groups, (d) oxazolidine groups, (e) allyl, vinyl, or other alkenyl or alkynyl groups possessing reactive unsaturation and (f) hydrogen...
(Ross, column 6, lines 13-33).

Applicant submits Ross appears to teach when R_1 is an aliphatic or allyl-ester, R_2, R_3 and R_4 may be an alkyl or allyl-ester group, R_2, R_3 and R_4 may be a linear or branched aliphatic aralkyl and aromatic hydrocarbon. Ross, however, does not appear to teach forming a diester

and/or triester compound. Applicant submits the diester quaternary ammonium compounds and triester quaternary ammonium compounds described in independent claims 48, 58, 59, 64, 73, 83 and 84 do not appear to be taught or suggested by Ross.

Applicant submits, for at least the reasons stated above, claims 48, 58, 59, 64, 73, 83 and 84 and the claims dependent thereon (claims 50-52, 56, 64-66, 71, 75-77, 81, 90-91, and 96 respectively) are patentable over Ross.

F. The Claims Are Not Obvious Over Ross Pursuant To 35 U.S.C. § 103(a)

The Examiner has rejected claims 1, 4, 5-10, 12, 13, 15-19, 20, 31-33, 35-41, 45, 63, 88, 112 and 116 as being unpatentable over Ross. Applicant respectfully disagrees with these rejections.

In order to reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 USPQ 173, 177-178 (C.C.P.A. 1967). To establish a *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

Independent claims 1 and 31 describe a combination of features including, but not limited to, the features of:

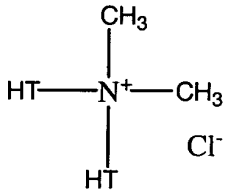
> wherein a diester quaternary ammonium component mixed with an additional quaternary ammonium compound, wherein the additional quaternary ammonium compound comprises a triester quaternary ammonium compound, a monoester quaternary ammonium compound or mixtures thereof.

The Examiner states, "the difference between the present invention and the disclosure of the prior art of Ross is teaching of using more than one ammonium compound" (Office Action, page 12). Applicant respectfully disagrees with these rejections.

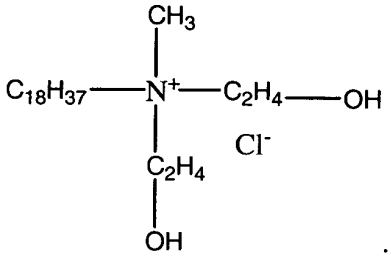
Applicant submits, for at least the reasons cited above, Ross does not appear to teach or

suggest diester quaternary ammonium compounds and/or triester quaternary ammonium compounds. As such, Applicant submits Ross does not appear to teach or suggest the combination of a diester quaternary ammonium compound with an additional quaternary ammonium component that includes a triester quaternary ammonium compound, a monoester quaternary ammonium compound or combinations thereof. Ross appears to teach combining alkyl quaternary ammonium compounds with a di-alcohol ammonium quaternary ammonium compound (M2HES). Ross states:

> Some examples of preferred quaternary ammonium compounds to make the compositions of this invention are:
>
> Dimethyl dehydrogenated tall ammonium chloride (2M2HT):

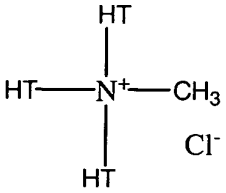


> wherein HT=Hydrogenated tallow.
>
> Methyl bis(2-hydroxyethyl)stearyl ammonium chloride (M2HES):



....

Methyl tris[hydrogenated tallow alkyl]chloride:



(Ross, column 7, lines 11-44).

Applicant submits Ross does not appear to teach or suggest a motivation to combine a diester quaternary ammonium compound with a triester quaternary ammonium compound, a monoester quaternary ammonium compound or mixtures thereof.

Regardless of the type of disclosure, the prior art must provide some motivation to one of ordinary skill in the art to make the claimed invention in order to support a conclusion of obviousness. See, e.g., *Vaeck* 947 F.2d at 493, 20 USPQ2d at 1442 (MPEP, 8th Edition, 1st Revision, 2100-142).

Applicant submits that claims 1, 31 and the claims dependent thereon (claims 4, 5-10, 12, 13, 15-19, 20, 32-33, 35-41, and 45) are patentable over Ross. Applicant further submits claims 63, 88, 112 and 116, for at least the reasons stated above, are patentable over Ross.

G. Summary

Based on the above, Applicant respectfully requests favorable reconsideration.

If any extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees are required or if any fees are inadvertently omitted or have been overpaid, please appropriately charge or credit those fees to Meyertons Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5628-00403/EBM

Respectfully submitted,

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